

IN THE CLAIMS

Please amend the claims as follows:

- Sub
Cl
B1
1. (Previously Amended) A computerized method for dental imaging comprising:
receiving a plurality of two-dimensional images of a oral cavity; and
generating at least one three-dimensional image of the oral cavity from the plurality of two-dimensional images, including:
generating shape-from-shading (SFS) data and range data using the plurality of two-dimensional images; and
processing the SFS data and the range data to generate the at least one three-dimensional image.
- B2
2. (Original) The computerized method of claim 1, wherein the plurality of two-dimensional images further comprises a plurality of two-dimensional optical images.
3. (Original) The computerized method of claim 1, further comprising:
constructing a physical cast of the oral cavity from the three-dimensional image.
4. (Original) The computerized method of claim 1, further comprising:
generating the plurality of two-dimensional images of the oral cavity from a common reference point in three-dimensional space.
- PM
5. (Previously Amended) The computerized method of claim 1, wherein processing the SFS data and the range data to generate the at least one three-dimensional images the generating further comprises:
generating shape-from-shading data from the plurality of two-dimensional images using a shape-from-shading process, the shape-from-shading data comprising a first plurality of three-dimensional points;
generating range data comprising a second plurality of three-dimensional points from the
- B

plurality of two-dimensional images using a range-data process;

fusing the range data to the shape-from-shading data, yielding fused data comprising a third plurality of three-dimensional points;

registering the fused data, yielding registered data comprising a fourth plurality of three-dimensional points; and

triangulating the registered data, yielding the at least one three-dimensional image of the oral cavity.

b3
cont

6. (Original) The computerized method of claim 5, wherein the generating shape-from-shading data further comprises:

estimating the direction of the illuminant from the plurality of two-dimensional images, in reference to camera intrinsic parameters; and

determining a solution to a brightness equation, yielding the shape-from-shading data comprising a first plurality of three-dimensional points.

7. (Original) The computerized method of claim 5, wherein the fusing the range data to the shape-from-shading data further comprises:

calculating the error difference in available depth measurements of the range data and the shape-from-shading data;

approximating a surface the fits the error difference, yielding an approximated surface; and

correcting the shape-from-shading data from the approximated surface, yielding fused data comprising a third plurality of three-dimensional points.

b4

8. (Previously Amended) A computer-readable medium having computer-executable instructions to cause a computer to perform a method comprising:

receiving a plurality of two-dimensional optical images of an oral cavity; and
generating at least one three-dimensional image of the oral cavity from the plurality of two-dimensional images, including:

B

B4
Conl

generating shape-from-shading (SFS) data and range data using the plurality of two-dimensional images; and
processing the SFS data and the range data to generate the at least one three-dimensional image.

- B4
Conl
9. (Original) The computerized method of claim 8, further comprising:
constructing a physical cast of the oral cavity from the three-dimensional image.
10. (Original) The computerized method of claim 8, further comprising:
generating the plurality of two-dimensional images of the oral cavity from a common reference point in three-dimensional space.

11. (Previously Amended) The computerized method of claim 8, wherein processing the SFS data and the range data to generate the at least one three-dimensional images the generating further comprises:

Bp

generating shape-from-shading data from the plurality of two-dimensional images using a shape-from-shading process, the shape-from-shading data comprising a first plurality of three-dimensional points;

generating range data comprising a second plurality of three-dimensional points from the plurality of two-dimensional images using a range-data process;

fusing the range data to the shape-from-shading data, yielding fused data comprising a third plurality of three-dimensional points;

registering the fused data, yielding registered data comprising a fourth plurality of three-dimensional points; and

triangulating the registered data, yielding the at least one three-dimensional image of the oral cavity.

- B7
12. (Original) The computerized method of claim 11, wherein the generating shape-from-shading data further comprises:
- B

estimating the direction of the illuminant from the plurality of two-dimensional images, in reference to camera intrinsic parameters; and

determining a solution to a brightness equation, yielding the shape-from-shading data comprising a first plurality of three-dimensional points.

13. (Original) The computerized method of claim 11, wherein the fusing the range data to the shape-from-shading data further comprises:

calculating the error difference in available depth measurements of the range data and the shape-from-shading data;

approximating a surface the fits the error difference, yielding an approximated surface; and

correcting the shape-from-shading data from the approximated surface, yielding fused data comprising a third plurality of three-dimensional points.

14. (Original) A three-dimensional digital image of a human oral cavity produced by the process comprising:

generating a plurality of two-dimensional optical images of the oral cavity from a common reference point in three-dimensional space;

generating shape-from-shading data from the plurality of two-dimensional images using a shape-from-shading process, the shape-from-shading data comprising a first plurality of three-dimensional points;

generating range data comprising a second plurality of three-dimensional points from the plurality of two-dimensional images using a range-data process;

fusing the range data to the shape-from-shading data, yielding fused data comprising a third plurality of three-dimensional points;

registering the fused data, yielding registered data comprising a fourth plurality of three-dimensional points; and

triangulating the registered data, yielding the one three-dimensional image of the oral cavity.

B1
Cont

B

15. (Original) The three-dimensional digital image of a human oral cavity of claim 14, produced by the process wherein generating shape-from-shading data further comprises:
estimating the direction of the illuminant from the plurality of two-dimensional images, in reference to camera intrinsic parameters.
16. (Original) A system/for dental diagnosis/comprising/
a processor/and
software means operative on the processor for generating a three-dimensional image of a human jaw/including generating shape-from-shading data that is generated from a direction of an illuminant of the jaw that is estimated in reference to camera intrinsic parameters./
17. (Original) A computerized system comprising:
a digitizer providing five degrees of freedom, having an arm;
a charge coupled device camera, rigidly mounted on the arm of the digitizer; and
a computer, operably coupled to the digitizer and the camera; receiving coordinate measurements from the digitizer and a plurality of two-dimensional images from the camera; and
generating a digital three-dimensional model from the coordinate measurements and from the plurality of two-dimensional images.
18. (Original) The computerized system of claim 17, further comprising:
a rapid prototyping machine operably coupled to the computer, receiving the digital three-dimensional model and generating a physical model of the digital three-dimensional model.
19. (Original) The computerized system of claim 17, further comprising:
a display operably coupled to the computer, receiving the digital three-dimensional model and generating an image of the digital three-dimensional model.
20. (Previously Amended) The computerized system of claim 17, the computer further

comprises:

a computer readable medium comprising means of:

generating shape-from-shading data from the plurality of two-dimensional images using a shape-from-shading process, the shape-from-shading data comprising a first plurality of three-dimensional points;

generating range data comprising a second plurality of three-dimensional points from the plurality of two-dimensional images using a range-data process;

fusing the range data to the shape-from-shading data, yielding fused data comprising a third plurality of three-dimensional points;

registering the fused data, yielding registered data comprising a fourth plurality of three-dimensional points; and

triangulating the registered data, yielding the one image of the three-dimensional image of the oral cavity model.

21. (Previously Added) A computerized method for dental imaging comprising:

receiving a plurality of two-dimensional images of a oral cavity; and

generating shape-from-shading data from the plurality of two-dimensional images using a shape-from-shading process, the shape-from-shading data comprising a first plurality of three-dimensional points; and

generating range data comprising a second plurality of three-dimensional points from the plurality of two-dimensional images using a range-data process;

fusing the range data to the shape-from-shading data, yielding fused data comprising a third plurality of three-dimensional points;

registering the fused data, yielding registered data comprising a fourth plurality of three-dimensional points; and

triangulating the registered data, yielding at least one three-dimensional image of the oral cavity.

22. (Previously Added) The computerized method of claim 21, wherein the generating

B

shape-from-shading data further comprises:

estimating the direction of the illuminant from the plurality of two-dimensional images, in reference to camera intrinsic parameters; and

determining a solution to a brightness equation, yielding the shape-from-shading data comprising a first plurality of three-dimensional points.

23. (Currently Amended) The computerized method of claim 21, wherein the fusing the range data to the shape-from-shading data further comprises:

calculating the error difference in available depth measurements of the range data and the shape-from-shading data;

approximating a surface that fits the error difference, yielding an approximated surface; and

correcting the shape-from-shading data from the approximated surface, yielding fused data comprising a third plurality of three-dimensional points.

24. (Previously Added) A computer-readable medium having computer-executable instructions to cause a computer to perform a method comprising:

receiving a plurality of two-dimensional optical images of an oral cavity; and
generating shape-from-shading data from the plurality of two-dimensional images using a shape-from-shading process, the shape-from-shading data comprising a first plurality of three-dimensional points;

generating range data comprising a second plurality of three-dimensional points from the plurality of two-dimensional images using a range-data process;

fusing the range data to the shape-from-shading data, yielding fused data comprising a third plurality of three-dimensional points;

registering the fused data, yielding registered data comprising a fourth plurality of three-dimensional points; and

triangulating the registered data, yielding at least one three-dimensional image of the oral cavity.

B9
cont

B

25. (Previously Added) The computerized method of claim 24, wherein the generating shape-from-shading data further comprises:

estimating the direction of the illuminant from the plurality of two-dimensional images, in reference to camera intrinsic parameters; and

determining a solution to a brightness equation, yielding the shape-from-shading data comprising a first plurality of three-dimensional points.

B9
Cone
26. (Previously Added) The computerized method of claim 24, wherein the fusing the range data to the shape-from-shading data further comprises:

calculating the error difference in available depth measurements of the range data and the shape-from-shading data;

approximating a surface the fits the error difference, yielding an approximated surface; and

correcting the shape-from-shading data from the approximated surface, yielding fused data comprising a third plurality of three-dimensional points.

B